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ECONOMIC RESEARCH SERVICE  
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CAN WE PRODUCE ENOUGH FOOD?\*

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G & P. PREP.

My assignment is to "evaluate the prospects of being able to produce the food required to meet the needs set forth in the first paper." The target date suggested was 1980. One of the needs emphasized by Mr. Brown was the need for increasing food production to feed the expanding world population. This need comes down to maintaining present levels of production per capita. The answer here, in my judgment, is "Yes, we can produce enough food to maintain total world food production per capita in the period from now to 1980."

It is true that per capita food production has been at a virtual standstill over the last six years. But, both the longer term trend over the past quarter century and the earlier postwar trend in per capita production has been upward. From 1935-39 to 1959-61, the rate of growth in world per capita food production was about one-fourth of one percent per year. From 1952-54 to 1959-61, the rate of growth was about .7 of one percent per year.<sup>1/</sup> The increase in world food production has occurred

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<sup>1/</sup> World Food Budget 1970, Foreign Agricultural Economic Report No. 19, Economic Research Service, U.S. Dept. of Agriculture, 1964. pp. 40-41. Calculations in compound annual rate of growth.

despite lower relative prices for agricultural products in several of the developed countries, and a marked decline in per capita food production in Communist Asia. Looking forward to 1980, there seems to be little reason, on the basis of recent price and production trends, why aggregate world production per capita cannot be maintained. Moreover, recent comprehensive projections of production and demand conditions for 1970 on a country by country basis indicate a prospective average rate of increase in food production per capita of about three-fourths of one percent during the 1959-61 to 1970 period.<sup>1/</sup>

But the major problem is not total world production. Most important will be the country and regional problems -- that is, meeting the food needs in some of the less-developed countries. Food production in the 1950's has been increasing at the rate of nearly 3 percent per year in both the developed and the less-developed countries, excluding Communist Asia (Table 1). But the high rate of population growth in the less-developed countries has meant little long-run growth in per capita food production for the less-developed countries. In some important countries and regions such as India, Latin America, and parts of South Asia, a decline in per capita food production has occurred in recent years. The high population growth rates in many of the less-developed countries are expected to increase further in the 1960-80 period. This high population growth will add to the present difficult problems of maintaining food production per capita in several of the less-developed countries. Meeting the food needs even at present levels of per capita consumption, consequently, would probably involve substantial problems of transferring food to some of these countries that do not have the foreign exchange to pay for it.

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<sup>1/</sup> World Food Budget 1970, op city, pp. 40-41.

Table 1.--Growth rate trends and 1980 projections.\*

Item	: Annual rate of growth, percent compounded		
	: Prewar to	: 1952-54 to	: Projected
	: 1959-61 <u>1/</u>	: 1959-61 <u>1/</u>	: 1980
	:	:	: potential <u>2/</u>
<u>Food Production</u>	:	:	:
Less Developed .....	2.1	3.0	3.2
Developed .....	1.7	2.9	2.6
<u>Population</u>	:	:	:
Less Developed .....	1.8	2.3	2.3
Developed .....	.8	1.0	1.0
<u>Per Capita Production</u>	:	:	:
Less Developed .....	.2	.6	.9
Developed .....	.8	1.8	1.6

\* Developed countries include North America, Australia, New Zealand, Japan, South Africa, and Europe including U.S.S.R. Other countries were classified as less-developed.

1/ Excludes Communist Asia. Calculated from indices of production, population, and per capita production, World Food Budget 1970, Foreign Agricultural Economic Report No. 19, Economic Research Service, U.S. Dept. of Agriculture, 1964. pp. 40-41.

2/ Based on projections by Cochrane, W.W.; Mackie, Arthur; and Chappell, Grover, "Potential Uses of Farm Products as Aid to Developing Countries," Journal of Farm Economics Proceedings Issue, December 1963. These projected rates would sustain a rate of per capita income growth of about 2½ percent in the less-developed countries.

The more relevant and more serious question is whether enough food can be produced in the right places to sustain an acceptable rate of economic growth for the expanding world population.

Food demands are likely to increase considerably faster than population. In the last decade, food production in the less-developed countries has not been sufficient to meet the needs arising from the combination of population growth and increased per capita incomes. During this period, population has been growing at about the annual rate of 2.3 percent, and per capita income in these developing countries has been growing in real terms at the rate of about 2 percent per year. As people in less-developed countries increase their income, a substantial part of the increase is spent for food. In some countries, the increased food demands arising from the combination of population increase and income growth have been accompanied by increased imports. In others, food prices have risen and the growth in income has been retarded by the resulting inflation.

Increased food needs will continue to rise from two main sources: (1) increased population, and (2) increased per capita income. The policies of both the developed and less-developed countries have stressed the importance of continued and expanded economic growth in the less-developed countries. It has become a major and important factor in maintaining political stability. A substantial part of the increase in income will be spent for more and better food.

Substantial increases in the demands for food arising from increased income, consequently, will occur if satisfactory rates of economic growth are attained in the less-developed countries. Food to meet the increased



food demands must come either from domestic production or imports.

Commercial food imports can be increased in some countries. Food aid can help. But in most countries a large part of the increase will need to be produced within the country because of shortages of foreign earnings and limitations on the amount of food aid that can be supplied by the developed countries.

Our concern, consequently, comes down to the prospects for producing and distributing the food supplies to sustain and promote reasonable rates of economic growth in the context of the projected higher rates of population growth. We can get some dimensions of the problem by referring to the projections for 1980 made about a year ago by Cochrane, Mackie, and Chappell in the Journal of Farm Economics.<sup>1/</sup> This study postulated a per capita growth rate in income of 3 percent in the rapid growth countries and 1½ percent in the slow growth countries.

The projections indicated a growth in food consumption demands in the less-developed countries of about 4 percent per year. This compares with an increase in food production of about 3 percent per year in these countries during the 1950's. The projected increase in the rate of growth in food production to a rate of 3.2 percent in these countries would be somewhat above the trend during the 1950's and considerably above the rate of growth in recent years.

It was assumed in this study that the rest of the deficit would need to come from the developed countries. In the developed countries there appears to be enough production capacity to produce the food needed, but getting the

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<sup>1/</sup> Cochrane, Willard W.; Mackie, Arthur; & Chappell, Grover. "Potential Uses of Farm Products as Aid to Developing Countries," Journal of Farm Economics, Proceedings Issue, December 1963.

huge volumes distributed to the less-developed countries will likely place limits on this approach to meeting world food needs. Food production has been increasing much faster than population in the developed countries, and per capita food demands increase little with growth and income. During the 1950's, food production in the developed countries has been increasing at the rate of nearly 3 percent per year, while population growth has been about one percent. With recent rates of growth in food production in the developed countries, the margin of food production over food demand in the developed countries would be fully sufficient to supply the remaining food needs of the less-developed countries. This would, however, require a massive increase in trade and aid from the developed countries amounting to about \$25 billion by 1980.

If economic growth in the rapidly developing countries is projected at the rate of 2 percent rather than the 3 percent rate used in the Cochrane, Mackie, and Chappell analysis, the increase in food imports and aid would be much more modest. On this basis, an increase of some \$7 billion in trade and aid would be needed. Even this would require a doubling of agricultural imports by the less-developed countries.

How valid is the assumption that production rates in the less-developed countries can be expanded? This question is of strategic importance to appraising whether enough food can be produced for an acceptable rate of economic growth. The projections assume that food production in the less-developed countries can be increased to an average rate of 3.2 percent per year. In countries with high population growth rates, the production growth rate may run as high as 4 to 5 percent per year.



It seems apparent to me that a considerable part of the increase in production will continue to come from increased acreages. In the past, most of the increase in output has come from this source. A study of the growth in production from prewar to postwar of twelve major crops by the FAO indicates that in the less-developed regions from two-thirds to over 90 percent of the increase in production arose from changes in crop area.<sup>1/</sup> Increased crop area reflects both increases in multiple cropping and increases in cultivated area.

According to Kellogg, the possibilities for increasing the cultivated area are still good in most of the developing countries. He says:

"This total of some 6,589 million acres (of potentially arable land) is not quite twice the figure the Food and Agriculture Organization gave in 1961 of arable land in use. --

"Most of the developing countries have large reserves of potentially arable soils that are now used only for extensive grazing or forestry, or that are not used at all."<sup>2/</sup> --

This should not be taken to mean that the cultivated area can or should be doubled by 1980. On the contrary, available evidence suggests that the crop area is likely to increase at a decreasing rate in the more densely populated countries. But it does suggest that changes in crop area are likely to continue to be of considerable importance in increasing agricultural production.

While the expansion of cultivated land area will continue to meet part of the future needs, this is not enough. I would like to join Mr. Brown in

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<sup>1/</sup> State of Food and Agriculture, 1963, page 101.

<sup>2/</sup> Kellogg, Charles E. "Potentials for Food Production," Farmer's World, 1964, Yearbook of Agriculture, pages 61, 64.

emphasizing the importance of yield increases in the less-developed countries. I think it is of strategic importance in expanding the rate of agricultural production. Analyses of 26 less-developed countries currently underway in Economic Research Service indicate that in most cases increases in crop production of 5 percent or more involved a combination of significant increases in output per acre and in acreage.<sup>1/</sup> Further, in some of the important densely populated less-developed countries yields may be the principal means of increasing agricultural production in the years ahead.

Brown's concept of a yield takeoff is an interesting hypothesis. But, I think we need to formulate more precisely our thinking with respect to the pre-conditions or factors that encourage increases in yields. I cannot agree, for example, that income is a necessary pre-condition of increasing yields. I note that Mexico, with per capita incomes similar to those in Algeria and Turkey, had the largest increases of wheat yields of any country in the world. Output and yield increases in the Sudan have been among the most rapid despite low per capita incomes and low levels of literacy.<sup>2/</sup>

On a more practical level, I would observe that if we must wait until income increases from the present level of perhaps \$100 to \$300 in the less-developed world to more than \$1,000 before agricultural yields increase substantially, a very long wait would indeed be involved. Instead, in the less-developed countries yields and incomes will have to be increased

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<sup>1/</sup> This study is part of the project, "Factors Associated with Differences and Changes in Agricultural Output and Productivity in Less-Developed Countries," sponsored by Agency for International Development, U.S. Dept. of State.

<sup>2/</sup> Op cit, "Factors Associated with Differences and Changes in Agricultural Output and Productivity in Less-Developed Countries."

together, as they in fact did in Japan. Since agriculture is the major sector of the economy in most of the less-developed countries, agricultural development must be one of the principal ways of obtaining rapid economic growth.

There are several highly relevant factors that encourage rapid development. These include such things as (1) agricultural leadership with a will to develop; (2) incentives for production which are associated with both the extent of growth in food demands and agricultural policies; (3) the presence of a backlog of technology derived from investment in local adaptive research; and (4) the organization of needed local agricultural services. Leadership with a will to develop agriculture is of basic importance since it affects all the other factors mentioned.

The agricultural policies with respect to incentives, effective organization of agricultural services to farmers, and agricultural research frequently have not provided an environment which would encourage increases in yields in many of the less-developed countries. For example, the prices farmers have received for rice in nearly all the Far Eastern countries are lower than the prices farmers receive in the U.S. The major exception is Japan, where rice prices are supported at levels much above those in the U.S. Prices in Taiwan are supported at approximately U.S. levels. Prices in other Far Eastern countries are substantially lower than in the U.S., and in exporting countries such as Thailand and Burma, prices to farmers and consumers are held much below world export price levels. Costs of fertilizer and pesticides, on the other hand, are generally higher than in the U.S.

A recent article by H. R. Von Uexkuell analyzes fertilizer use in these countries. He finds fertilizer usage much below recommended rates in all these countries, except Japan and Taiwan. He concludes that "the actual fertilizer usage follows closely the relative fertilizer cost" - and - "yields are closely associated with....fertilizer input." <sup>1/</sup>

His data indicate that farmers can buy less than one-half as much nitrogen with a pound of rice in Indonesia, Viet Nam, and Thailand as can be bought with a pound of rice in the U.S. This is also true of Burma, where other data show less than one-third as much fertilizer can be purchased from the production of a pound of rice as in the U.S. The comparable figure for India has been slightly over one-half as much fertilizer for a pound of rice production as in the U.S. All these countries are using low amounts of fertilizer. Their yields are from one-third to one-half the yields of rice in the U.S.

But the adequacy of plant breeding research, other agronomic research, and farm management is also important in explaining these differences in yields. Herdt and Mellor have shown that the response of 20 and 40 pounds of nitrogen on rice yields in India is only about two-thirds that in the U.S. Further, when used at rates of above 50 pounds, nitrogen reduced yields in India, whereas in the U.S. the crops continued to respond to nitrogen up to 120 pounds per acre. <sup>2/</sup> They attribute the higher potentials in the U.S. largely to the work of plant breeding, agronomy, agricultural engineering, and farm management specialists.

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<sup>1/</sup> Von Uexkuell, H.R. "Obstacles to Using Fertilizer for Rice in S.E. Asia," World Crops, March 1964.

<sup>2/</sup> Herdt, Robert W., and Mellor, John W. "Contrasting Response of Rice to Nitrogen: India and the U.S." p. 155.

The essential point illustrated by these studies is that the lack of progress in crop yields in many of these countries can be traced to their agricultural policies. While rice has been used as an example, a similar situation exists with respect to a number of food consumption crops in many of the less-developed countries. The question of whether enough food can be produced to meet the total needs for development must turn to a considerable extent on whether these policies are changed.

In conclusion, it appears that we can be optimistic about producing enough during the period from now until 1980 to maintain present per capita food consumption levels. But this is not enough to provide the food to sustain both the rapid growth in population and rapid economic development, measured in terms of growth in per capita incomes. It appears doubtful whether we can produce enough food in the right places to sustain rapid rates of economic growth for the expanding world population without substantial changes in agricultural or population policies. To meet this challenge probably will require greatly increased cooperation from the developed world, and most important, greatly increased emphasis on increasing agricultural production in the less-developed countries. Finally, it should be recognized that the prospects of producing enough food to sustain rapid economic development will be much better if effective actions are taken which result in a leveling off or reduction in the rate of population growth.



